Chapter 2
DESCRIPTION OF THE WATER BODY

INTRODUCTION

The Caloosahatchee River and Estuary and its upstream watershed are located along the lower west coast of Florida within the Caloosahatchee Watershed Planning Area (**Figure 2**). This watershed drains an area of over 1,300 square miles extending 66 miles from Lake Okeechobee to the mouth of the Caloosahatchee Estuary (San Carlos Bay). The Caloosahatchee River (C-43), along with the St. Lucie Canal (C-44) are important components of the Central and Southern Florida (C&SF) Project and are used primarily for water releases from Lake Okeechobee when lake levels exceed United States Army Corps of Engineers (USACE) regulation schedules (USACE 2000b) established for flood protection. In addition to regulatory discharges for flood protection, the river also receives water deliveries from the lake to maintain water levels for river navigation and water supply for agriculture and urban users (SFWMD, 2000d).

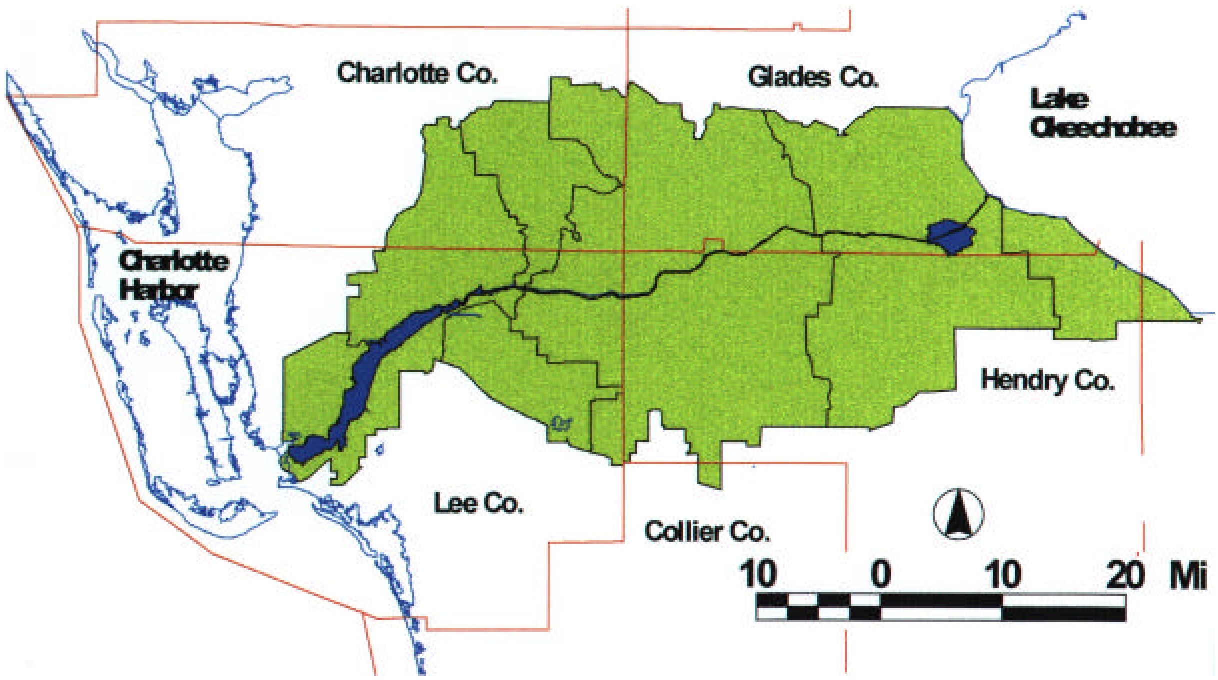

Figure 2. Caloosahatchee Watershed Planning Area

CLIMATE, RAINFALL AND SEASONAL WEATHER PATTERNS

The hydrology of Southwest Florida is strongly affected by its climate, rainfall and seasonal weather patterns. The climate of the Caloosahatchee watershed is classified as subtropical. The annual average temperature is about 74°F with monthly averages ranging from near 63^{o}F in winter to near 83^{o}F during summer (**Table 1).** Winters are mild with warm days and moderately cool nights. Occasional cold fronts can bring temperatures near 32^{o}F, but very seldom result in a hard freeze. During summer average maximum temperatures near 90^{o}F and, under rare circumstances, maxima have recorded as high as 100^{o}F. The mean values of temperature, precipitation, winds, and relative humidity for Ft. Myers are given in **Table 1**.

Table 1. Normal Monthly Values of Temperature and Precipitation at Ft. Myers

Month	Temperature (^{o}F)	Precipitation (In.)
January	63.5	1.52
February	65.2	2.21
March	68.2	2.62
April	72.8	2.64
May	77.4	3.85
June	80.8	8.96
July	82.2	9.08
August	82.7	7.38
September	81.3	8.50
October	76.1	4.09
November	69.2	1.20
December	65.0	1.29
	Average 73.7	**Total 53.3**

Rainfall averages 53 inches annually, with heaviest precipitation during the summer **(Table 1).** Based on precipitation, a “wet” and “dry” season can be established. Most (71 percent) of the annual precipitation (38 inches) falls during the wet season, which extends from June to October. In contrast only 29 percent (15.3 inches) of this total falls during the dry season. During the winter and early spring dry season there some years in which there are long periods of time in which there is little or no rainfall resulting in a regional drought. In contrast, the passage of tropical storms or hurricanes over the area can result in 6 to 10 inches of rainfall in one day. Thunderstorms are infrequent from November to April but they occur on an average two out of three days from June through September. Storms are usually brief but intense and peak during the late afternoon or early evening (SFWMD, 2000d).

There is also a high variability in rainfall at different locations in the watershed. The inland portion of the watershed receives more rain than the coast during the dry season (**Figure 3)**. On average the wet season rainfall is greater along the coast. Although November is the driest month, April is the month with the greatest water use demand.

Tropical storms and hurricanes that affect the area originate in the Atlantic Tropical Cyclone Basin. This area includes the North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico. Hurricane season extends from June through November and peaks in September and October when ocean temperatures are warmest and humidity is highest. Major effects from these storms are flooding, from rainfall and wind-generated tides and waves, storm surge, wind damage, and flushing of the river and estuary.

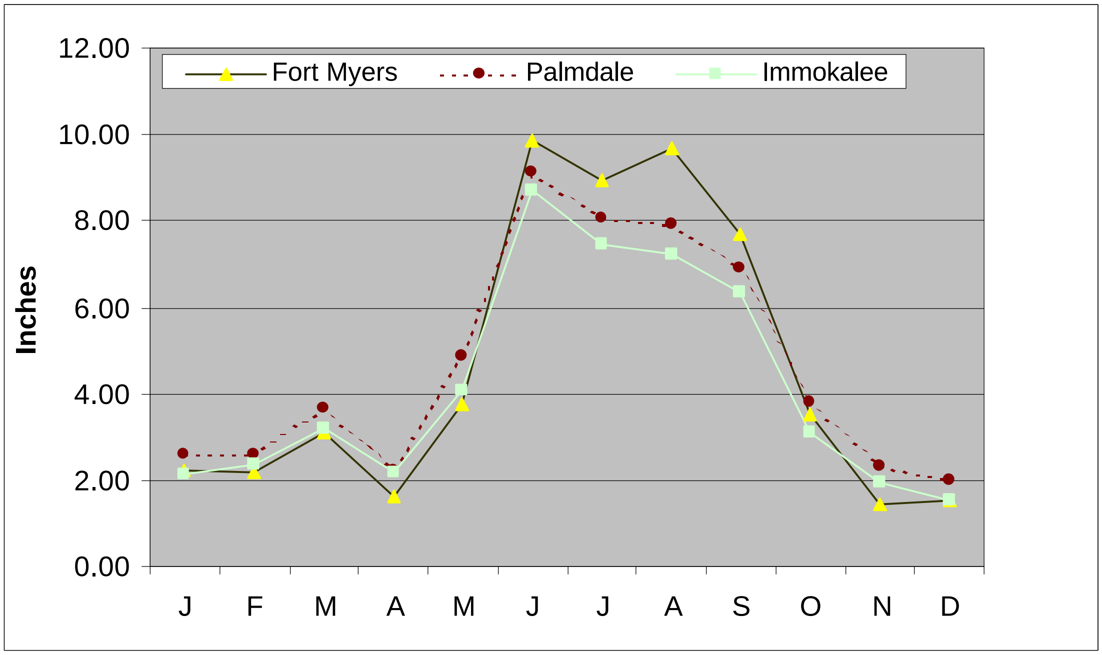

Figure 3. Spatial Variability of Average Monthly Rainfall in the Caloosahatchee Basin.

MAJOR BASINS

Caloosahatchee River and Upstream Watershed

The upstream freshwater portion of the river extends east from the W.P. Franklin Lock (S-79) to the S-77 structure located on the southwestern shore of Lake Okeechobee, a distance of 44 miles. Along this stretch of the river C-43 ranges from 50 to 140 yards in width with water depths ranging from 20 to 30 feet deep. Many of the original bends in the river remain today as oxbows along both sides of the canal. The pattern and period of flow within the river is highly variable based on the need for regulatory discharges from Lake Okeechobee, surface water runoff from the surrounding watershed and the need for irrigation and water supply for urban areas.

Prior to development of the region, the Caloosahatchee River was a sinuous river extending from Beautiful Island to a waterfall at the west-end of Lake Flirt. A sawgrass marsh extended from Lake Flirt to Lake Okeechobee. The pre-development landscape had few tributaries east of LaBelle and Twelve-mile Slough connected the Okaloacoochee Slough to the Orange River (**Figure 4**).

The area east of LaBelle was flat and there were few creeks to provide drainage. These waters moved westward eventually spilling over falls and wandering slowly through a series of oxbows before entering the upper reaches of the tidally driven downstream estuary. The estuary accepted overland sheet flow during the dry season as well as an occasional deluge of water during the wet season as a result of a passing hurricane or tropical storm. This range of flows largely determined what portions of the river system would become estuarine in nature characterized by a mixing zone of fresh and brackish water of low salinity. This area of fresh/brackish water moved unimpeded landward under low flow conditions and seaward with increasing flows (Haunert et al. in review).

Over the past century, the hydrology of the Caloosahatchee watershed has been strongly affected by regional drainage improvements, land use changes and development. Beginning in the late 1800's, Hamilton Disston excavated a canal to connect Lake Okeechobee to the Caloosahatchee River and Gulf of Mexico to improve transportation and lower the lake for development. In 1918, three major locks were constructed along the canal to improve navigation, and from 1920-1930 the river channel was enlarged to a six-foot depth and ninety feet width (USACE 1957). To accommodate navigation, flood control, and land reclamation needs, the freshwater portion of the river was reconfigured into a canal known as C-43. Numerous canals were constructed along the banks of the river in support of agricultural communities located along the river. In addition, three lock-and-dam structures (S-77, S-78, and S-79) were added to control flow and stage height.

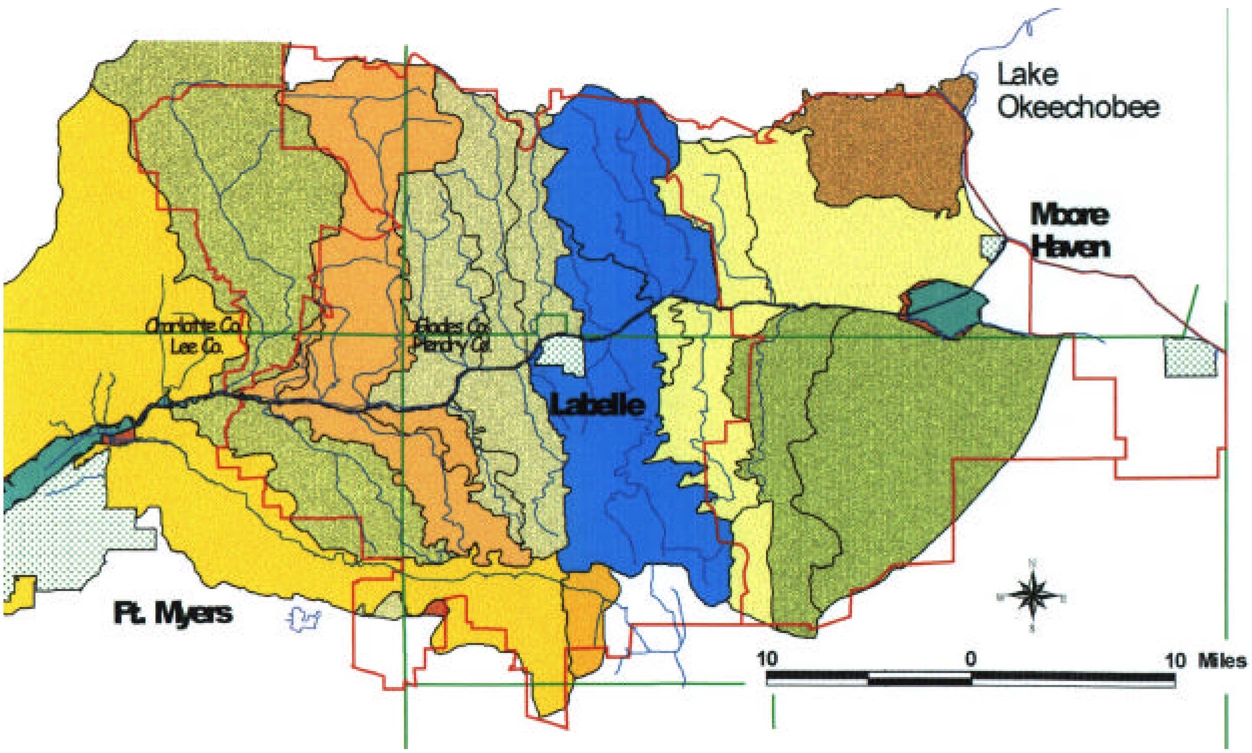

Figure 4. Pre-Development Hydrology in the Caloosahatchee Basin

The final downstream structure (S-79) marks the beginning of the Caloosahatchee Estuary. Also called the W.P. Franklin Lock and Dam, this structure maintains specified water levels upstream, regulates freshwater discharge into the estuary, and acts as an impediment to saltwater intrusion to the upstream portion of the river. The Moore Haven Lock (S-77), located on the southwest shore of Lake Okeechobee, regulates lake waters. The Ortona Lock (S-78) aids in control of water levels on adjacent lands upstream and separates C-43 into two distinct hydrologic units, the East and West Basins (**Figure 5**). These basins include portions of Lee, Charlotte, Collier, Glades, and Hendry Counties. Tributary drainage in the East Basin is more complex than the West Basin. Irrigation for agriculture is the most important water use the East Basin and is controlled by an extensive network of canals that recharge the water table during the dry season and drain floodwaters during the wet season. Land use in the West Basin is also largely agricultural.

Today, the C-43 Canal (Caloosahatchee River) is the most significant source of surface water in the Caloosahatchee Basin. The C-43 Canal receives water from Lake Okeechobee, runoff from the watershed and base flow from the Surficial Aquifer System. The river in turn supplies water for public supply, agriculture, and the environment. This source can be unreliable during the dry season or periods of inadequate rainfall, when releases are required from Lake Okeechobee to meet demand. The U.S. Army Corps of Engineers manages the C-43 Canal via a regulation schedule, which presently accommodates navigational, flood protection, water supply, and environmental needs.

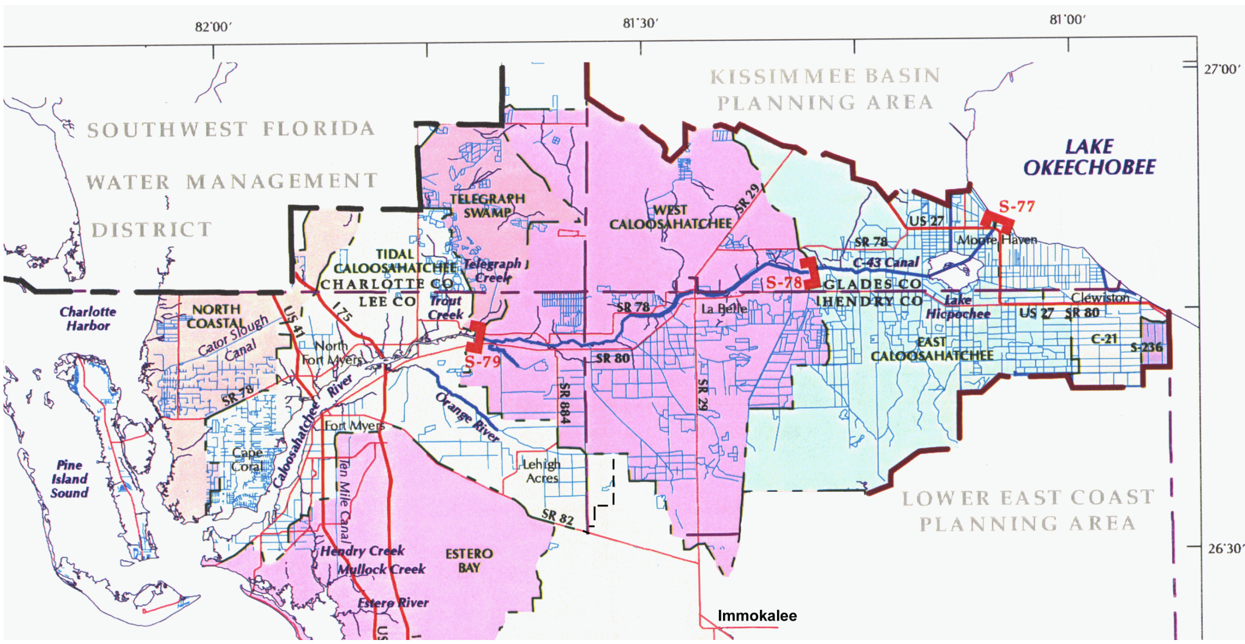

Figure 5. Major Basins and Water Management Features in the Caloosahatche Basin

The Lake Okeechobee Demand (Service) Area, which is defined as the area that is or could be supplied by surface water from the Caloosahatchee River, is the primary source for agricultural irrigation and potable surface supply water in the Caloosahatchee watershed. This area extends from the Franklin Lock (S-79) eastward to the Moore Haven Lock (S-77) and includes land in Lee, Glades, and Hendry counties.

Other surface water bodies located within the Caloosahatchee Planning Area include lakes, rivers, and canals. These areas provide storage and allow conveyance of surface water. Lake Hicpochee is the largest lake in the planning area and is bisected by C-43 just west of Lake Okeechobee (**Figure 5).** Numerous canals and tributaries in the planning area drain into the Caloosahatchee River. The major tributaries are the Orange River and Telegraph Slough, which drain into C-43 in the western portion of the watershed, near W. P. Franklin Lock and Dam (S-79). The majority of the canals in the watershed were constructed as surface water drainage systems rather than for water supply purposes.

Caloosahatchee Estuary

The Caloosahatchee Estuary is a large estuarine ecosystem where the waters of the Gulf of Mexico mix with the freshwater inflows from the river, sloughs, and overland sheet flow from the upstream basin **(Figure 6**). The area is characterized by a shallow bay, extensive seagrass beds, and sand flats. Extensive mangrove forests dominate undeveloped areas of the shoreline. The width of the estuary varies from 175 yards in the upper portion, to more than 1.5 miles wide downstream at San Carlos Bay (Scarlatos 1988). The tidal portion of the river includes parts of Lee and Charlotte Counties. The estuary length between the Franklin Lock and Shell Point is 26 miles and is bordered by Fort Myers on the south shore and Cape Coral on the north shore (**Figure 6).** Water discharges from the Caloosahatchee passes Shell Point and enters the Gulf of Mexico at San Carlos Bay. Because of the irregular, long, slender shape of the system, relatively small changes in wind, tide, runoff, or precipitation can have dramatic effects on flow, water depth, salinity, and turbidity.

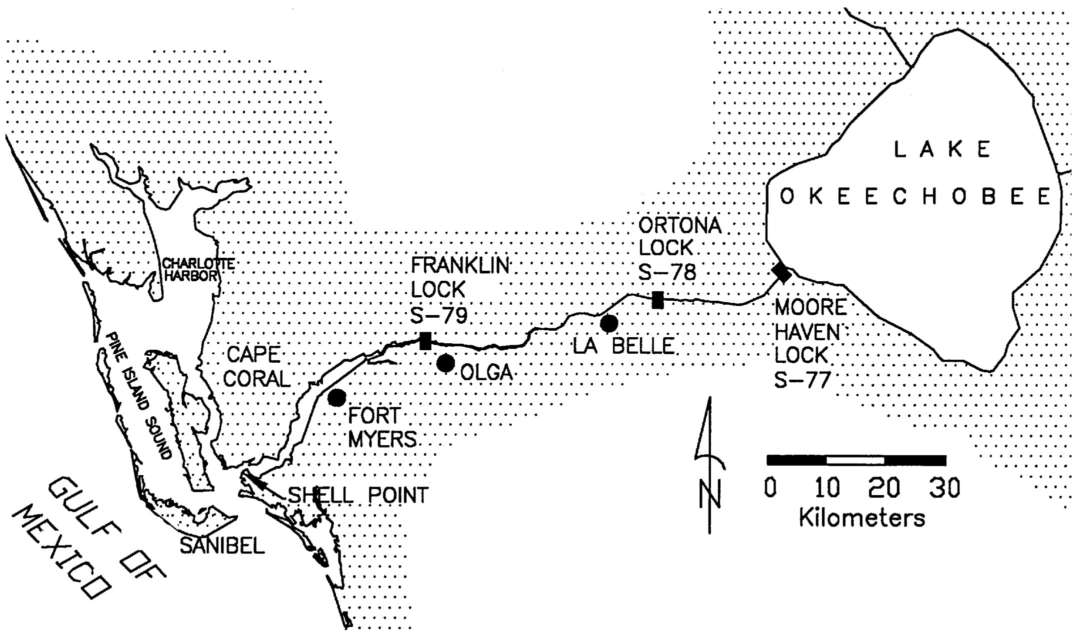

Figure 6. General Plan View of the Caloosahatchee River and Estuary

The river provides the primary source of fresh water for the estuary through structure S-79, although local basin runoff may exceed river flow during periods of heavy local rainfall. The freshwater, upstream portion of the river extends east from S-79 and connects with Lake Okeechobee. The downstream, estuarine portion of the river extends west from S-79 and empties into San Carlos Bay at Shell Point (Figure 6). The river (canal C-43) bisects the Caloosahatchee watershed and functions as a primary canal that conveys storm water runoff, regulatory releases from Lake Okeechobee, provides navigation for large boats along the Okeechobee Water Way and provides recreational opportunities for boating, fishing and wildlife observation. The estuary is an important nursery ground for many commercially and recreationally important fish and shellfish species. The estuary also provides foraging areas and wetland habitat for a large number of Florida's rare, endangered, and threatened species.

Maintenance of appropriate freshwater inflows is essential for a healthy estuarine system. Preliminary findings indicate that optimum inflows to the Caloosahatchee Estuary should have mean monthly values that range between 300 and 2,800 cubic feet per second (cfs) (Chamberlain et al., 1995). Average daily flows between January 1988 and June 1999 were approximately 500 cfs. Low flows of 0 cfs and high flows as high as 17,283 cfs were recorded during the same period. Excessive freshwater inflows to the estuary result in imbalances beyond the tolerances of estuarine organisms. The retention of water within upland basins for water supply purposes can reduce inflows into the estuary and promote excessive salinities. Conversely, the inflow of large quantities of water into the estuary due to flood control activities can significantly reduce salinities and introduce stormwater contaminants. In addition to immediate impacts associated with changes in freshwater inflows, long-term cumulative changes in water quality constituents or water clarity may also adversely affect estuarine communities (Doering and Chamberlain, 1999).

Estuarine biota are well adapted to, and depend on, natural seasonal changes in salinity. The temporary storage and concurrent decrease in velocity of floodwaters within upstream wetlands aid in controlling the timing, duration, and quantity of freshwater flows into the estuary. Upstream wetlands and their associated ground water systems serve as freshwater reservoirs for the maintenance of base flow discharges into the estuaries, providing favorable salinities for estuarine biota. During the wet season, upstream wetlands provide pulses of organic detritus, which are exported downstream to the brackish water zone. These materials are an important link in the estuarine food chain.

Tape grass, *Vallisneria americana*, is one of the dominant submerged aquatic plants in the upper Caloosahatchee River Estuary, and occurs in well-defined beds in shallow waters. *V. americana* has been identified as important habitat for a variety of freshwater and estuarine invertebrate and vertebrate species, including some commercially and recreationally important fish (Bortone and Turpin 1998). Additionally, it can serve as a food source for the Florida manatee.

Estuaries are important nursery grounds for many commercially important fish species. Many freshwater wetland systems in the planning area provide base flows to the estuary. Wetlands as far inland as the Okaloacoochee Slough in Hendry County contribute to the base flows entering the estuarine system. Maintenance of these base flows is crucial to propagation of many fish species, such as grouper, snapper, and spotted seatrout, which is the basis of extensive commercial and recreational fishing industries.

The estuarine environment is sensitive to freshwater releases, and disruption of the volume, distribution, circulation, and temporal patterns of freshwater discharges could place severe stress on the entire ecosystem. "Such salinity patterns affect productivity, population distribution, community composition, predator-prey interactions, and food web structure in the inshore marine habitat. In many ways, salinity is a master ecological variable that controls important aspects of community structure and food web organization in coastal systems" (Myer and Ewel,1990). Other aspects of water quality, such as turbidity, dissolved oxygen, nutrient loads, and toxins, also affect functions of these areas (Myers and Ewel, 1990).

LAND USE

Land use within the watershed is predominantly rural and agricultural in nature in the eastern portion of the watershed, and urban in the western portion. The predominant land use within the Caloosahatchee Water Management Planning Area is agricultural and is expected to remain so in the future (SFWMD, 2000d). Citrus is the dominant irrigated crop in the basin and occupies over 91,000 acres, according to SFWMD 1995 land use data. Over the past two decades, Southwest Florida has had the fastest growing citrus acreage in the state. This is associated with the movement of citrus southward from Central Florida following several severe winter freezes in the mid-1980s.

Sugarcane, with an estimated 75,000 acres, according to the 1995 Land Use Coverage, closely follows citrus in dominance. It is produced in the Caloosahatchee watershed in close vicinity to Lake Okeechobee, in Hendry and Glades counties, where transportation costs to the mills can be minimized. Sugarcane acreage has continued to increase since 1995, and is expected to continue to increase in the future.

Native/natural land uses are also predominant in the basin, however this land use can be expected to decrease as the watershed is further transformed into agriculture and urban uses. Urban land use follows behind, and is predominant in the western portion of the basin (SFWMD, 2000d). The distribution of general land use and natural features is shown in **Figure 7.**

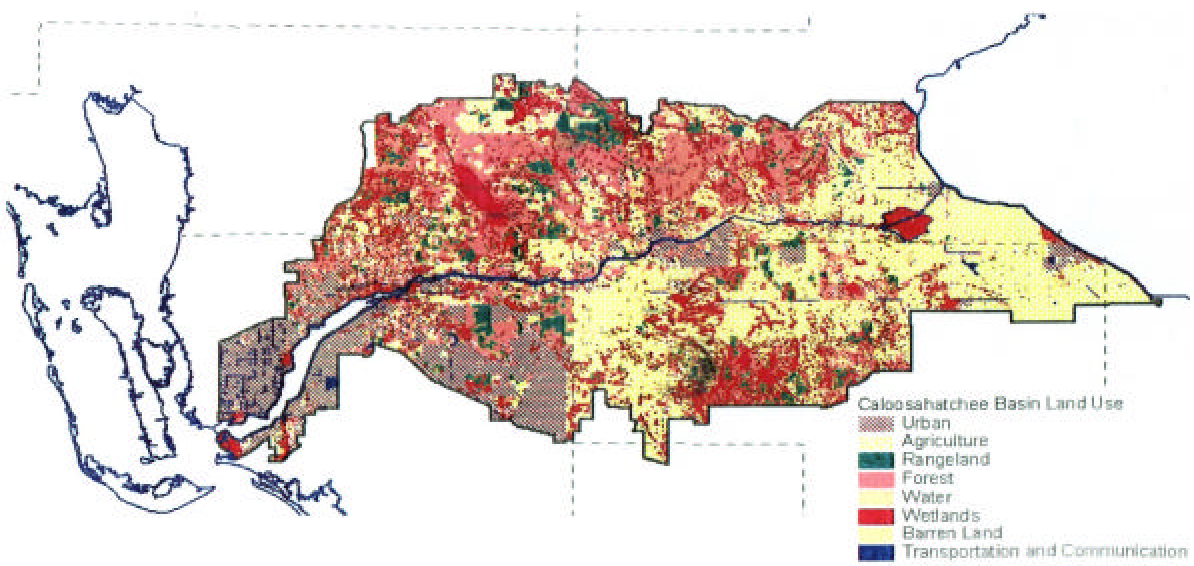

Figure 7. Land Use in the Caloosahatchee Watershed

WATER RESOURCES

Surface Water Systems

Surface water flows in the watershed are derived from rainfall within the basin and from discharge from Lake Okeechobee. Runoff from the West Caloosahatchee Basin is slightly higher than runoff from the East Caloosahatchee Basin indicating the greater flow attenuation in eastern basin due to the flatness and thick, sandy soils (Fan and Burgess, 1983). There is little water storage in the watershed. The intensive drainage on the south side of the river provides little storage. The north side of the river is largely undeveloped west of Lake Hicpochee and although there is considerable wetland water storage, it is not managed water storage.

Lake Okeechobee

Lake Okeechobee, which covers 730 square miles, is the largest freshwater lake in the southeastern United States. The lake receives significant volumes of runoff from the Kissimmee River, which begins near Orlando, the Upper Chain of Lakes, Lake Istokpoga and numerous small inflows along the north shore of the lake in the wet season. During the pre-development period, Lake Okeechobee discharged to the south and west, into the Everglades and the Caloosahatchee watershed during high water periods. The United States Army Corps of Engineers (USACE) and the SFWMD now control the outfall from the lake. Numerous canals connect the lake to the East and West Coasts as well as the Everglades.

The Caloosahatchee River (Canal C-43) receives water from Lake Okeechobee for flood control and water supply. Regulatory discharges via C-43 to lower lake-stage for flood protection, is 37% of total surface water discharge from Lake Okeechobee (Fan and Burgess, 1983). In wet years, this has resulted in discharge as great as the total runoff from the watershed. Water is also released to control algal blooms in the river (Miller *et al*., 1982). At low flow, alga blooms develop in the canal between S-78 and S-79, producing poor drinking water quality for Ft. Myers and Lee County water supplies. Water is released from the lake to flush this water out of the river. Water also is released to push salt water out of the river section that has entered through the locks. The air bubbling system, when adequately maintained, assists in alleviating the problem. This salinity approaches federal drinking water standards at the fresh water intakes. Flushing has been shown to be effective and has been reduced due to use of the air curtain. The standard water release schedule from Lake Okeechobee through S-77 to avoid dangerously high lake stages is as follows (**Figure 8**):

Zone A: Release up to 7800 cfs, the maximum capacity of S-77

Zone B: Release 6500 cfs

Zone C Release non-harmful discharge, up to 4500 cfs

Zone D: No regulatory release.

In addition there are pulse releases prescribed in Zone D that lower lake stage with minimal impact to the estuary. The pulse releases consist of 10-day pulses that follow the release patterns that were designed to reflect the natural hydrology of storm water runoff. The release rate begins low on the first day and is increased to the highest release rate on the third day followed by reduced flow rates for days seven through ten. After day ten the pattern of discharge is repeated until the lake level is sufficiently lowered. The pulse releases increase from Level I to Level III as shown in **Table 2**. The level of release is determined by stage in Lake Okeechobee.

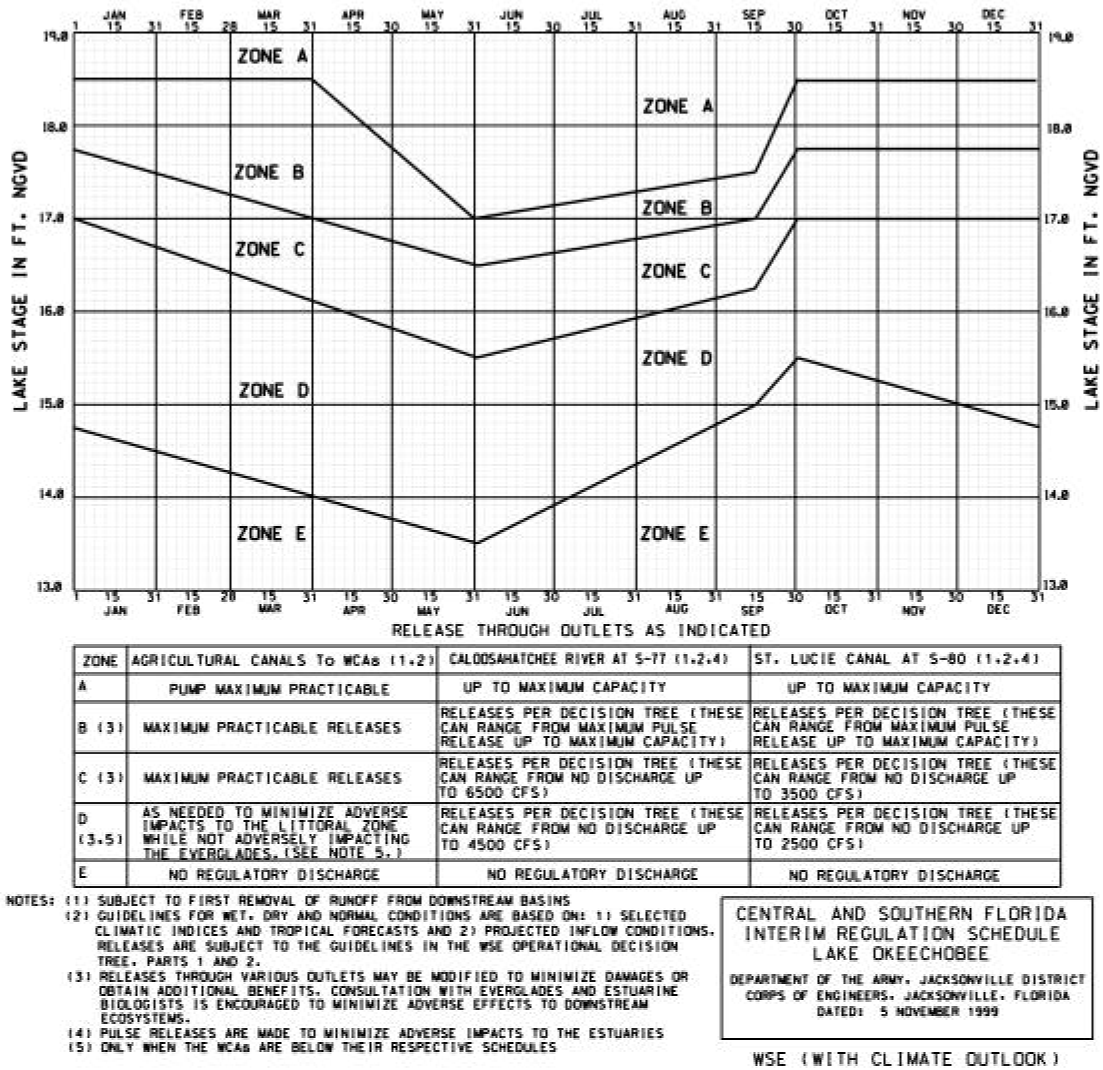

Figure 8. Lake Okeechobee Regulation Schedule

Table 2. Caloosahatchee River Pulse Release Schedule for Zone D of the Lake Okeechobee Regulation Schedule

Day of Pulse	Level 1	Level 2	Level 3
Cfs =cubic feet per second			
1	1,000	1,500	2,000
2	2,800	4,200	5,500
3	3,300	5,000	6,500
4	2,400	3,800	5,000
5	2,000	3,000	4,000
6	1,500	2,200	3,000
7	1,200	1,500	2,000
8	800	800	1,000
9	500	500	500
10	500	500	500

Lake Okeechobee is an important feeding and roosting area for wading birds and migratory waterfowl and is highly regarded for it's recreational and commercial fishing. Winter visitors from the northern United States who value the recreational fishing and the slower pace of interior South Florida visit the lake.

Groundwater and Aquifer Systems

Groundwater is an important component of agricultural water supply within the watershed. The groundwater resources in the area include the Surficial Aquifer System (SAS), the Intermediate Aquifer System (IAS), and the Floridan Aquifer System (FAS) as shown in **Table 3.** The yield and storage of the groundwater is highly variable throughout the watershed. Where possible, surface water has been used for irrigation. The SAS is used for some irrigation in eastern Hendry and Glades counties. The IAS is used primarily for irrigation in the western portion of Hendry County. There is local recharge to both the SAS and the IAS. The FAS is used in northern Glades County for irrigation and in the northwest corner of the watershed and mixed with surface water for irrigation. The water from the FAS is too highly mineralized elsewhere in the watershed. This deep aquifer is recharged from outside the area.

Table 3. Generalized Hydrogeology of the Caloosahatchee Watershed

Hydrogeologic System	Hydrogeologic unit	Aquifer thickness (feet)	Water Resources Potential
Surficial Aquifer System (SAS),	Water Table aquifer	20-75	Important source of local irrigation
	Tamiami Confining Zone	20-75	
	Lower Tamiami Aquifer	50-150	Important irrigation source in eastern Hendry County, disappears in western Hendry and Glades County
Intermediate Aquifer System (IAS)	Upper Hawthorn Confining Zone	300-500	
	Sandstone Aquifer		Water source in western Glades and Hendry County, however, low yield and highly variable
	Mid-Hawthorn Confining Zone		
	Mid-Hawthorn Aquifer		Water source in western Lee County, absent elsewhere.
	Lower-hawthorn Confining Zone		
Florida Aquifer System (FAS)		Insufficient data	Important irrigation source in northern Glades County, elsewhere too mineralized.

Source: (Herr and Shaw, 1989)

Surface Water/Groundwater Relationships

The SAS is unconfined and directly connected with surface waters. The Water Table Aquifer is recharged from infiltration and deep seepage from wetlands and canals. As such, surface water management has a direct impact on the Water Table Aquifer. Excessive drainage may divert water to the estuary rather than to groundwater recharge. The Water Table Aquifer is hydraulically connected to the Lower Tamiami Aquifer and surface water management directly affects recharge to the Lower Tamiami.

The IAS is partially connected with surface waters. The Sandstone Aquifer is separated from the Caloosahatchee River by confining layers; however, the Sandstone Aquifer is recharged from surface water in southeastern Lee County. Recharge also occurs in the Immokalee area from the Water Table Aquifer and flows in a northwest direction toward the river as well as to the south. The Mid-Hawthorn Aquifer is recharged from an area as far away as 100 miles north of the basin. The FAS is not hydraulically connected naturally to surface water or the other aquifer systems. However, there are approximately 200 flowing wells that discharge water into surface waters. Many of these wells are uncased or have corroded casings that allow mixing of highly mineralized water of the FAS with the IAS.

Protection of the Lower West Coast Aquifer System

As part of the Central and Southern Florida (C&SF) Project, the Caloosahatchee River plays a critical role as a source of fresh water to maintain coastal ground water levels which prevent saltwater intrusion of the Lower West Coast Aquifer system. During dry periods when freshwater supplies are depleted along the lower west coast of Florida, fresh water is discharged from interior storage areas such as Lake Okeechobee to the Caloosahatchee river system. These water releases help maintain a freshwater head within the coastal ground water aquifers that prevents inland movement of the saltwater front. Saltwater intrusion can occur whenever water levels within the Caloosahatchee river or the aquifer drop below the elevation needed to stabilize the adjacent saltwater front.

Water Supply

The Caloosahatchee River is the primary source of surface water in the region. The river is supplied by three major sources: precipitation, releases from Lake Okeechobee, and ground water seepage. The principle water use/loss mechanisms are evaporation, evapotranspiration (including irrigation), discharge to the estuary for environmental needs and public water supply. The freshwater portion of the river (C-43 Canal) extends eastward from the Franklin Lock and Dam (S-79) towards Lake Okeechobee. West of S- 79, the river mixes with estuarine water as it empties into the Gulf of Mexico.

Water for urban and agricultural uses in the Caloosahatchee Watershed Planning Area is supplied from both groundwater and surface water systems. Surface water is used primarily for agricultural irrigation, with groundwater being used in areas that do not have access to the river. In addition, the Caloosahatchee River is a source for potable water supply in Lee County (SFWMD, 2000d)..

Non-environmental surface water demands within the basin are primarily agricultural with some public water supply, commercial and industrial uses. The commercial and industrial demands vary greatly by type of business. In the Caloosahatchee Watershed Planning Area commercial and industrial demands are about one percent (1%) of the overall water demands. Because the demand is relatively small and difficult to generalize, an average demand is not calculated for this use category. The emphasis is placed on estimation of agricultural and public water supply uses.

In estimating public water use for 1995, metered data of withdrawals from the C-43 for the City of Fort Myers and Lee County Utilities at Olga were obtained from SFWMD records. Based on the 1995 data and planned future developments that the City of Fort Myers and Lee County utilities will serve, the 2020 public water supply use from the C-43 was also estimated.

A different procedure was adopted for estimating agricultural use in the Caloosahatchee Planning Area because measured withdrawal data were not available. The procedure used estimated current water use based on three approaches; evaluation of permitted water use allocation records, Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) water demand modeling, and integrated surface water/groundwater modeling using MIKE SHE.

In each approach, the demand was related to current land use. The resulting demands from each approach were reviewed to evaluate reasonableness. Based on the comparison, a methodology was developed that used both AFSIRS and MIKE SHE simulations to determine the current and 2020 agricultural demands.

The estimate of 2020 agricultural demand is dependent on the 2020 agricultural land use projections. Analysis of land use data was therefore a crucial component of the agricultural demand estimation within the Caloosahatchee Planning Area.

In all cases when and where possible, information from the Caloosahatchee Advisory Committee, representatives of public water supply utilities, representatives of the agricultural community and other stakeholders, was used to augment or verify the estimates generated by SFWMD staff.

Public Water Supply Demands

The primary public water supply utilities utilizing water from the C-43 Canal within the Caloosahatchee Planning Area are the City of Fort Myers and Lee County utilities. The City of Fort Myers withdraws water from the river at Olga to recharge the surficial aquifer at its wellfield. The water is then pumped from the aquifer for treatment using membrane-softening technology. The 1995 withdrawals by the City of Fort Myers are summarized in **Table 4** below. Lee County Utilities withdraws surface water from the C-43 Canal at Olga and treats the water using lime softening technology at its Olga water treatment plant. The Lee County Utilities withdrawals are also summarized in **Table 4** below. The combined surface water usage by both utilities was approximately 10.5 MGD on average and more than 16-MGD maximum in 1995.

Table 4. Monthly Public Water Supply Use from C-43 for 1995

Month	Fort Myers			Lee County Olga Plant		
	Total (MG)	Avg (MGD)	MAX (MGD)	Total (MG)	Avg (MGD)	MAX (MGD)
Jan.- 95	272.35	8.79	10.23	104.89	3.38	3.82
Feb.- 95	252.75	9.03	10.21	104.11	3.72	4.13
Mar.- 95				112.64	3.63	4.03
Apr.- 95	299.73	9.99	12.16	107.04	3.57	4.03
May- 95	314.93	10.16	11.66	98.89	3.19	3.76
Jun.- 95	22.57	7.42	11.34	84.88	2.83	3.17
Jul.- 95	117.62	5.73	11.33	82.87	2.67	3.28
Aug.- 95	106.09	3.42	8.26	75.81	2.45	3.18
Sep– 95	109.77	3.66	9.36	75.01	2.50	2.88
Oct. - 95	124.80	4.03	9.36	85.68	2.76	3.46

Nov.– 95	275.41	9.18	11.05	97.75	3.26	3.78
Dec.- 95	288.98	9.32	11.93	98.24	3.17	3.79
Summary 1995	2,445.00	7.34	12.16	1127.82	3.09	4.13
Permitted	4,043	11.08	15.72	1124.2	3.08	5.00

Agricultural Water Demands

Agricultural water use depends on the crops that are grown in the watershed and on how those crops are managed and irrigated. An important factor in accurately estimating agricultural water use is determining the location and acreage of crops. Land use in the Caloosahatchee Planning Area is mostly agricultural and is expected to remain so in the future (SFWMD, 2000d).

Citrus is the dominant irrigated crop in the basin and occupies more than 91,000 acres, according to the SFWMD's 1995 Land Use Coverage. During the past two decades, Southwest Florida has had the fastest growing citrus acreage in the state. This growth is associated with the movement of citrus southward from Central Florida following several severe winter freezes in the early-1980s.

Sugarcane, with an estimated 75,000 acres, according to the SFWMD's 1995 Land Use Coverage, closely follows citrus in dominance of land area. Sugarcane is primarily grown in close vicinity to the Everglades Agricultural Area, in Hendry and Glades counties, where transportation costs to sugar mills can be minimized. Sugarcane acreage has continued to increase since 1995, and is expected to continue in the future (SFWMD, 2000d).

Based on the recommended development of water management and storage infrastructure to effectively capture and store the surface water flows in the Caloosahatchee Basin, the projected surface water needs of this basin and the estuary can be met (SFWMD, 2000d). Supplemental agricultural demands from surface water sources within the basin are projected to increase from 200 MGD to 285 MGD (230,000 to 320,000 ac-ft/yr) based on projected 2020 land use and public water supply needs from the Caloosahatchee River are projected to increase from 12 to 16 MGD (13,000 to 18000 ac-ft/yr) by 2020. The environmental needs of the Caloosahatchee Estuary have been estimated at 400 MGD (450,000 ac-ft/yr) while average flows to the estuary are estimated to be approximately 580 MGD (650,000 ac-ft/yr. Flow to the estuary in excess of the needs can, therefore, be as high as 180 MGD (200,0000 ac-ft/yr) on average.

WATER QUALITY

A critical relationship exists between water quality and human activity, including the withdrawal of water for supply. Increased withdrawals may cause a rise in the concentrations of impurities in the remaining water. Other human activities such as waste disposal and pollution spillage have the potential of degrading ground and surface water systems.

Water quality within the Caloosahatchee River basin is threatened by altered freshwater inputs, nutrient loads from agricultural activities, anthropogenic organic compounds, trace elements, as well as overall urban growth and development within the watershed. The integrity of riverine and estuarine ecosystems is dependent on water quality. As water quality diminishes, so does the overall quality of the system (SFWMD, 2000d)

In 1976 it was determined that water quality data was needed to determine the health of the Caloosahatchee River. A baseline water quality database was created in 1978, yielding a database, which has helped the SFWMD determine management practices within the Caloosahatchee basin and watershed. Recently, data has been collected and complied from Lee County, the City of Cape Coral, East County Water Control District, and SFWMD to evaluate the water quality from the urban portion of the Caloosahatchee watershed. Average nutrient concentrations were calculated for individual sub-basins and primary basins, and average nutrient loads were calculated for the primary basins.

The SFWMD is continuing water quality monitoring within the Caloosahatchee River through contracts with local and state agencies. Several projects incorporate water quality monitoring, including the SFWMD's VEC (Valued Ecosystem Component) study, and the South Florida Restudy.

The Florida Center for Environmental Studies (FCES) is currently monitoring eight water quality sites within the Caloosahatchee River and estuary system. These sites are between Shell Point, at the mouth of the river, to just above S-79 (W.P. Franklin Lock). Each of the eight sitess are monitored monthly and samples are taken from two fixed depths within the water column. The FCES is also performing water quality biomonitoring using the freshwater grass *Vallisneria americana* (tape grass) to determine the effects of freshwater pulsing from Lake Okeechobee. This data will help to refine the current pulse release schedule that will help protect the integrity of the *Vallisneria* community as well as the estuarine ecosystem.

Environmental Research and Design Inc., a consulting firm from Orlando, will conduct event sampling. Their data will be used to determine nutrient loading in the Caloosahatchee Estuary and the response of estuarine nutrient concentrations to external inputs. By identifying rates of nutrient loading from wastewater treatment facilities, and rivers and streams, nutrient inputs can be ranked in order of importance. The project will provide a data set that can be used to quantify the degree to which nutrient concentrations in the estuary depend on loading from external sources.

The U.S. Geological Service was contracted to sample bottom sediments from 35 sites in the Caloosahatchee Estuary, including upstream of S-79. This project will provide the SFWMD with a complete assessment of total nitrogen, phosphorus, and potential toxic substances within the estuary. Other sample sites for this project are located in San Carlos Bay, Estero Bay, and Pine Island Sound. A final report was submitted to the SFWMD in 1999 (SFWMD 2000d)

NATURAL SYSTEMS

Wetlands

Wetlands in the Caloosahatchee Basin

Inland portions of the Caloosahatchee Basin include freshwater swamps, sloughs, and marshes. These wetland areas serve as important habitat for a wide variety of wildlife and have numerous hydrological functions.

Before the development of Southwest Florida, inland areas were comprised of vast expanses of cypress and hardwood swamps, freshwater marshes, sloughs, and flatwoods.

Scattered among these systems were oak/cabbage palm and tropical hammocks, coastal strand and xeric scrub habitats. A large portion of the area contained seasonally flooded wetlands in which fresh water sheet flowed from northeast to southwest. Water bodies within the Caloosahatchee Basin include natural lakes, man-made impoundments, rivers, and creeks.

Wetlands perform a number of hydrologic and biological functions valuable to man including flood protection and prevention of erosion, receiving and storing surface water runoff, natural biological filtration for water quality improvement, ground water recharge-discharge areas, and serve as important habitat for a wide variety of aquatic dependent wildlife including a number of rare threatened or endangered species.

Two significant natural wetland systems in the Caloosahatchee Basin are Twelve Mile Slough and the Okaloacoochee Slough. Both are located south of the river. The Twelve-Mile Slough is located in Hendry County and is a tributary to the much larger and regionally significant Okaloacoochee Slough. It covers 3,300 acres and contains a mosaic of freshwater wetlands, as well as pine flatwoods and oak/cabbage palm hammocks. Surface water storage in the numerous wetlands provides for groundwater recharge of the underlying Surficial Aquifer and provides surface water supply to the Caloosahatchee River. A portion of the Okaloacoochee Slough is located in the Caloosahatchee watershed, in Hendry County. It flows both north, toward the Caloosahatchee River, and south toward Collier County and is a major headwater for the Fakahatchee Strand and the Big Cypress National Preserve. This slough system is composed largely of herbaceous plants with trees and shrubs scattered along its fringes and central portions. Its extensive network of sloughs and isolated wetlands store wet-season runoff from the surrounding uplands and provide year-round base flow to downstream natural areas. The Okaloacoochee Slough, Harn’s Marsh, and Orange River system provide habitat for a variety of wildlife such as the endangered Florida panther.

Wetland systems north of the river include portions of Fisheating Creek and Telegraph Cypress Swamp. Fisheating Creek is a major wetland in western Glades County. It is an extensive riverine swamp system that forms a watershed covering hundreds of square miles.

Although Fisheating Creek is located in the Kissimmee Basin Planning Area, it delineates the northern boundary of the Caloosahatchee Basin. Fisheating Creek is the only free flowing tributary to Lake Okeechobee. The creek attenuates discharges from heavy storm events and improves water quality before the storm water enters the lake. The creek also serves as a feeding area for wading birds such as the endangered wood stork, white ibis, and great egrets, when stages in the marshes surrounding Lake Okeechobee are too high.

Telegraph Cypress Swamp is located in eastern Charlotte County. It is a diverse system with a mixture of hydric flatwoods, cypress strands, and marshes. Within Lee County there are several free flowing creeks that enter the river west of S-79 such as Hancock, Yellow Fever, Powell, Doughtrey, Bedman and Hickey. The headwaters for Hancock, Yellow Fever, Powell, and Doughtrey creeks are in Charlotte County.

Thirty-five side channels, or oxbows, of various sizes and geomorphic configurations are found along the channelized river from the town of LaBelle down to the W.P. Franklin Lock and Dam. The ecological condition of these oxbows varies from reasonably good, in those few with significant flow-through, to very poor in those where flow is restricted or blocked and significant organically rich sediments have accumulated (Cummins and Merritt, 1999). The long-term management objective for oxbows is to enhance their capacity as water quality filters and for off-channel water storage during wet periods by rehabilitating them to flow-through conditions.

Research is being conducted to assess the present ecological state of the river's oxbows. Ten oxbows have been selected for a study that includes water quality sampling; remote sensing and GIS mapping; channel geomorphic and plant bed measurements; plant bed and sediment macroinvertebrate functional groups; and fish diversity and functional groups. To date, the macroinvertebrate analysis has been completed and recommendations have been made for oxbow restoration based on this data. Other components of the study are to be completed in April 2000. At that time, final recommendations for oxbow restoration will be made (SFWMD 2000d).

Wetland Protection Criteria

In order to assess the potential harmful impacts of cumulative water use on the environment and ground water resources using the ground water modeling tools, the potential impacts must be defined in terms of water levels and duration and frequency of drawdowns. These water levels are referred to as resource protection criteria. The resource protection criteria are guidelines used to identify areas where there is potential for cumulative water use withdrawals to cause harm to wetlands and ground water resources. In areas where simulations show the resource protection criteria are exceeded for the selected level of certainty, the water resource may not be sufficient to support the projected demand under the constraints.

The District's Resource Protection Criteria are designed to prevent harm to the resources up to a 1-in-10-drought event. These criteria are not intended to be a minimum flow and level. For drought conditions greater than a 1-in-10 event, it may be necessary to decrease water withdrawals to avoid causing significant harm to the resource. Water shortage triggers, or water levels at which phased restrictions will be declared under the SFWMD's water shortage program, can be used to curtail withdrawals by water use types to avoid water levels declining to and below a level where significant harm to the resource could potentially occur. The District's wetland protection criterion is defined as follows:

> *Ground water level drawdowns induced by cumulative pumping withdrawals in areas that are classified as a wetland should not exceed one foot at the edge of the wetland for more than one month during a 12-month drought condition that occurs as frequently as once every 10 years*.

For planning purposes, this criterion was applied to surficial aquifer drawdowns in areas that have been classified as a wetland according to the National Wetlands Inventory.

The District's Basis of Review for water use permit applications (SFWMD 1997a), requires that withdrawals of water must not cause adverse impacts to environmental features sensitive to magnitude, seasonal timing and duration of inundation. Maintaining appropriate wetland hydrology (water levels and hydroperiod) is scientifically accepted as the single most critical factor to maintain a viable wetland ecosystem (Duever, 1988; Mitch and Gosselink, 1986; Erwin, 1991). Water use induced drawdowns under wetlands potentially affect water levels, hydroperiod, and areal extent of the wetland. A guideline of no more than one foot of drawdown at the edge of a wetland after 90 days of no recharge and maximum day withdrawals is used currently for consumptive use permitting purposes to indicate no adverse impacts. Wetlands for CUP purposes are delineated using statewide methods described in Chapter 62-340, F.A.C.

Uplands

Upland communities in the Caloosahatchee Basin include pine flatwoods, tropical hammocks, mesic oak, dry prairie, and xeric scrub communities, with flatwoods being the dominant upland habitat. Flatwood communities are divided into two types: dry and hydric. Dry flatwood communities are characterized by an open canopy of slash pine with an understory of saw palmetto. However, dry flatwoods are located in a slightly higher elevation in the landscape and are rarely inundated.

Hydric flatwood communities (wetlands) are vegetatively similar to dry flatwoods. Large areas of flatwoods are found throughout Hendry and Lee counties, as well as portions of Charlotte, Glades, and Collier counties. Upland flatwoods are the native habitats most affected by the expansion of citrus into southwest Florida. Flatwoods are important habitat for a number of threatened and endangered species such as the Florida panther, Florida black bear, eastern indigo snake, red-cockaded woodpecker and the gopher tortoise. Pine flatwoods have a greater richness of vertebrate species than either sand pine or dry grass prairies (Myers and Ewel, 1990).

Tropical hammocks are rare in the basin. This diverse woody upland plant community occurs on elevated areas, often in Indian shell mounds along the coast, or on marl or limestone outcroppings inland. As a result of urban development, tropical hammocks are among the most endangered ecological communities in South Florida

Xeric, sand pine, and oak scrub communities most commonly occur along ridges and ancient dunes. They are often associated with relic sand dunes formed when sea levels were higher. These well-drained sandy soils are important aquifer recharge for coastal communities. The sand pine and oak scrub is the most endangered ecological community present within the planning area. It is rapidly being eliminated by conversion to other land uses.

Upland plant communities serve as recharge areas, absorbing rainfall into soils where it is distributed into plant systems or stored underground within the aquifer. Groundwater storage in upland areas reduces runoff during extreme rainfall events, while plant cover reduces erosion and absorbs nutrients and other pollutants that might be generated during a storm event. With few exceptions, the functions and values attributed to wetlands also apply to upland systems. Upland/wetland systems are ecological continuums, existing and adapting to geomorphic variation. The classification of natural systems is artificial and tends to convey a message that they survive independently of each other. In reality, wetland and upland systems are interdependent. To preserve the structure and functions of wetlands, the linkage between uplands and wetlands must be maintained (Mazzotti et al., 1992).

Fauna

Southwest Florida, in general, has a rich diversity of native fauna. These include endemic and sub-tropical species that cannot be found anywhere else in the United States. The Caloosahatchee Basin supports a diverse and abundant array of fish and wildlife species, including many endangered and threatened species (**Table 5).**

Table 5. Listed Faunal Species in the Caloosahatchee Basin

Scientific Name	Common Name	Federal Status	State Status
AMPHIBIANS .			
Rana capito	Gopher frog		SSC
REPTILES			
Alligator mississippiensis	American alligator	T(S/A)	SSC
Caretta caretta	Loggerhead sea turtle	T	T
Chelonia caretta	Green sea turtle	E	E
Dermochelys coilacea	Leatherback sea turtle	E	E
Drymarchon corais couperi	Eastern indigo snake	E	T
Eretmochelys imbricata	Hawksbill sea turtle	E	E
Gopherus polyphemus	Gopher tortoise		SSC
Lepidochelys kempii	Kemp's ridley sea turtle	E	E
Crocodylus acutus	American crocodile	E	E
Pituophis melanoleucus mugitus	Florida pine snake		SSC
BIRDS,			
Ajaia ajaia	Roseate spoonbill		SSC
Aphelocoma coerulescens	Florida scrub-jay	T	T
Aramus jzuarauna	Limpkin		SSC
Caracara plancus	Audubon's crested caracara	T	T
Charadrius alexandrinus tenuirostris	Southeastern snowy plover		T
Charadrius melodus	Piping plover	T	T
Egretta caerulea	Little blue heron		SSC
Egretta thula	Snowy egret		SSC
Egretta tricolor	Tricolored heron		
Eudocimus albus	White ibis		SSC
Falco peregrinus tundrius	Arctic peregrine falcon	E	E
Falco sparverius paulus	Southeastern American kestrel		T
Grus canadensis pratensis	Florida sandhill crane		T
Haematopus palliatus	American oystercatcher		SSC
Haliaeetus leucocephalus	Bald eagle	T	T
Myctetia americana	Wood stork	E	E
Pelecanus occidentalis	Brown pelican		SSC
Picoides borealis	Red-cockaded woodpecker	E	T
Rhyncops niger	Black skimmer		SSC
Rostrhamus sociabilis plumbeus	Everglades snail kite	E	E
Speotyto cunicularia floridia	Florida burrowing owl		SSC
Sterna antillarum	Least tem		T
MAMUALS			
Blarina brevicauda shermanii .	*Sherman's* short-tailed shrew		SSC
Felis concolor coryi	Florida panther	E	E
Felis concolor	Mountain lion	T	E
Mustela vison evergladensis	Everglades mink		T
Oryzomys palustris sanibelli	Sanibel Island rice rat	E	SSC
Podomys floridanus	Florida mouse		SSC
Sciurus niger avicennia	Big Cypress fox squirrel		T
Trichechus manatus latirostris	Florida manatee (subspecies of the West Indian manatee)	E	E
Sciurns niger shennani	Sherman's fox squirrel		SSC
Ursus americanus floridanus	Florida black bear		T
FISH			
Acipenser oxyrhynchus	Atlantic sturgeon	SSC	T
Centropomus undecimalis	Common snook SSC	SSC	
Cyprinodon variegatus hubbsi	Lake Eustis pupfish SSC	SSC	

T = Threatened E = Endangered SSC = Species of Special Concern
S/A = Due to similarity of appearance to endangered species.
Source: (USFWS 1998 & FGFWFC 1997)

The Caloosahatchee Estuary serves as a particularly important center of abundance in the state for the Florida Manatee. Likewise, Telegraph Swamp and Corkscrew Regional Ecosystem are Strategic Conservation Areas for the Florida Panther (Cox et al., 1994).

The Florida Fish and Wildlife Conservation Commission in their Closing the Gaps in Wildlife Habitat Conservation System (GAPS) described habitat in Florida that should be conserved if key components of the state's biological diversity are to be maintained. Habitat areas identified for each species are called Strategic Habitat Conservation Areas (SHCA) because of their importance in providing some of Florida's rarest species with the habitat needed for long-term persistence (Cox et al., 1994).

According to Florida Fish and Wildlife Conservation Commission's Closing the Gaps in Florida's Wildlife Habitat Conservation System (Cox et al., 1994), the region was identified as possibly the most important area in Florida in terms of maintaining several wide-ranging species that make up an important component of wildlife diversity in the state. Furthermore, the southwest Florida region is a unique place for the concentration of migratory species. Many birds use the area for wintering, breeding, feeding, and nesting. In addition, several species of marine fish depend on the fresher water estuary as a spawning and nursery area.

WATER RESOURCE ISSUES

The major water resource issues associated with management of the Caloosahatchee River and estuary include the following:

Hydrologic Alteration of the Watershed

The hydrological alterations of the watershed have dramatically changed the natural quantity, quality, timing and distribution of flows to the Caloosahatchee Estuary with limited regard to maintaining the biological integrity of the ecosystem. The Lake Okeechobee SWIM Plan (SFWMD 1989, 1997b), recognized that adverse impacts to the Caloosahatchee Estuary occur when regulatory releases are made through C-43 Canal for lake flood protection purposes. Large, unnatural freshwater releases from the lake through the C-43 to the Caloosahatchee Estuary alter the estuarine salinity gradient and transport significant quantities of sediment to the estuary. Biota within the Caloosahatchee Estuary, and near-shore seagrass beds have been impacted by these high volume discharges (USFWS 1957: Harris et al. 1985; Haunert and Chamberlain 1994; Hoffacke 1994).

During the wet season, rainfall runoff that was historically retained and/or evaporated within the watershed now reaches the estuary in greater volume and less time (USACE 1957). During the dry season, agriculture and urban water supply demands result in reduced flows to the estuary. In addition to changing the flow characteristics of the watershed, the construction of S-79 truncated the estuary by blocking the natural gradient of freshwater/saltwater that historically extended into the upper reaches of the estuary during the dry season from November to May. Under current dry season conditions, it is common to observe waters immediately downstream of S-79 to be nearly one-third the salt content of the Gulf of Mexico while those immediately upstream of the structure are fresh. The loss of the fresh-brackish water habitat has resulted in the loss of an important water resource function of the estuary during the dry season.

There is evidence that water management practices have impacted the estuary and its biota. Alterations in the delivery of freshwater at S-79 cause salinity to vary widely in time and space. Depressed salinity during large discharge events results in the emigration of certain finfish and the mortality of non-mobile benthic invertebrates (USFWS 1957). Analysis of historical vegetation maps indicates a significant decrease in submerged aquatic (vascular) vegetation (SAV) downstream of Shell Point (Harris *et al*. 1983). Submerged aquatic vegetation within the estuary, upstream of Shell Point, have been shown to be sensitive to salinity and freshwater inflow (McNulty *et al*. 1972; Haunert and Chamberlain 1994; Hoffacker 1994; Chamberlain Doering 1998a, 1998b).

Water Supply

The water needed to meet MFL requirements represents a substantial requirement within the basin. During wet years, much more than the minimum flow amount of water is available for discharge to the estuary. In fact, the problem becomes that of too much water. During average years, more than sufficient water is available from the basin to meet the needs of agriculture urban residents and natural systems. During dry periods, however, more water is used in the basin than can be obtained from local rainfall. Water is delivered from Lake Okeechobee as needed to maintain water levels in the River and meet agricultural and urban demands in the Caloosahatchee River. Use of water from the Lake must compete with other regional demands in the Upper East Coast and Lower East Coast Planning Areas.

Water use in the Caloosahatchee Basin was estimated as part of the Caloosahatchee Water Management Plan (SFWMD 2000d). Agricultural demands from surface water sources within the basin are estimated to increase from 230,000 acre-feet per year (200 MGD) based on 1995 land use, to approximately 320,000 acre-feet per year (285 MGD) on average based on projected 2020 land use. Public water supply needs from the Caloosahatchee River are projected to increase from 13,000 (12 MGD) in 1995 to 18,000 acre-feet per year (16 MGD) on average by 2020. The environmental needs of the Caloosahatchee Estuary have been estimated at 450,000 acre-feet (400 MGD) while average flows to the estuary are estimated to be approximately 650,000 acre-feet per year (580 MGD

As water levels decline in Lake Okeechobee, the Supply-Side Management plan is activated and water use may be restricted according to the District's water shortage plan. This plan provides for progressive, phased restrictions on water use that are designed to protect the resource from incurring significant harm or serious harm. When drought conditions are of sufficient magnitude that water resources begin to experience harm, the SFWMD Governing Board may require restrictions on operational deliveries and water uses, pursuant to the Water Shortage Rule 40E-21 F.A.C.

Development of water management and storage infrastructure to effectively capture and store the surface water flows in the Caloosahatchee Basin is proposed as part of the Caloosahatchee Water Management Plan (SFWMD 2000d) and the Lower East Coast Regional Water Supply Plan (SFWMD 2000 b) and the Comprehensive Everglades Restoration Plan (USACE and SFWMD 1999). With these facilities in place, the projected future (2020) surface water needs of the basin and the estuary can be met. The evaluated components, once constructed, would be adequate to meet the demands in the basin during a 1-in-10 drought event.

In the short-term, an adaptive water management strategy is proposed in this report as a means to provide minimum flows to the estuary when water is available from Lake Okeechobee.

Water Quality Degradation

Water quality within the Caloosahatchee River basin is threatened by altered freshwater inputs, nutrient loads from agricultural activities, anthropogenic organic compounds, trace elements, as well as overall urban growth and development within the watershed. The integrity of riverine and estuarine ecosystems is dependent on water quality. As water quality diminishes, so does the overall quality of the system. The Florida Department of Environmental Regulation (DeGrove 1981, DeGrove and Nearhoof 1987, Baker 1990) reported that the estuary had reached its nutrient loading limits as indicated by elevated chlorophyll a and depressed dissolved oxygen.

Need for *Maximum* Flow Criteria

Establishing *minimum* levels alone will not be sufficient to maintain a sustainable resource or protect it from significant harm. For both Lake Okeechobee and the Caloosahatchee Estuary, floods or extended periods of high water result in the need to release large volumes of water to the estuary for flood protection purposes. These high volume discharges have been shown to significantly impact the resource. Setting a minimum flow is viewed as a starting point to define the water needs of the estuary for sustainability. The necessary hydrologic regime for restoration of the regional ecosystem must also be defined and implemented through the use of water reservations and other water resource protection tools. Achieving the required water levels and flows throughout this system is an overall, long-term restoration goal of the Comprehensive Everglades Restoration Program (CERP), the LEC and LWC Water Supply Plans and the Caloosahatchee Water Management Plan.

Under current conditions, *Maximum flows* delivered to the estuary are controlled largely by the Lake Okeechobee regulation schedule and pulse releases for these estuaries. The overall ability of these schedules to protect the resource is uncertain due to the limited water storage capacity of the regional system, especially during high rainfall years. As a result, new or revised minimum and maximum flow criteria are being considered for both the Caloosahatchee and St. Lucie estuaries as part of the regional water supply planning process and CERP.

Navigation

The Caloosahatchee River (C-43 Canal) flows east to west across the northern portion of the LWC planning area connecting Lake Okeechobee in the east and the Gulf of Mexico in the west. The Caloosahatchee River is supplied by inflows from Lake Okeechobee and runoff from within it’s own basin. As a result, water levels in the river are low during dry times, when demand is highest and the river is almost entirely dependent on Lake Okeechobee. However, during the rainy season, when demands are minimum, significant volumes of excess water are discharged into the Gulf of Mexico. To maintain navigation at the W.P. Franklin Lock (S-79), the USACE releases water as needed from Lake Okeechobee to maintain a minimum water level of 3.0 ft, NGVD (27 ft channel depth) above S-79. However, the Corps may lower stages at S-79 below 3.0 ft, NGVD in advance of a major storm as part of their emergency action plans.

Control of Saltwater Intrusion

During extreme dry periods (usually the months of April and May) flows within the Caloosahatchee River may be reduced to near zero flow. When this condition prevails, navigation lockages through the W.P. Franklin Lock (S-79) result in a saltwater wedge that moves upstream of S-79 into the freshwater reach of the river. Increased boat lockages result in more salt water moving upstream. Eventually, the chloride content of the water entering the municipal water intakes of Ft. Myers and Lee County exceeds the drinking water standard of 250 ppm. When this happens, the SFWMD requests the USACE to release water from Lake Okeechobee to flush out the salt water with a short-term high rate of discharge from the lake. A “pulse release” type of discharge approach has been used as well as smaller lower volume releases (e.g., 300 cfs monthly average) to reduce chloride levels within the river and provide benefits to the downstream estuary. During a declared water shortage period, the SFWMD has requested the USACE to initiate reduced hours of boat lockages through S-79 to prevent an increase in chloride levels upstream of S-79. (Lake Okeechobee Master Water Control Manual, USACE, 2000,).

Control of Algae Blooms

Again, during dry periods (months of December to April) flows within the Caloosahatchee River have been diminishes to the point that the river acts more like a reservoir than a flowing river system. Under these conditions occasional algae blooms (some severe) have been reported to develop in the river above the Franklin Lock and Dam. The City of Ft. Myers and Lee County both have municipal water intakes in this area which could be clogged by the algae or result in taste and odor problems that need to be addressed as part of the water plant treatment process. Short-term high rates of discharge from Lake Okeechobee have been required to break up the algae bloom. This is done by the USACE whenever requested by the SFWMD.